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DPD-3762-62

19 June 1962

MEMORANDUM FOR: Director, NPIC

ATTENTION :

25X1A

THROUGH : Acting Chief, DPD

SUBJECT : Monthly Status Report
Contract No. BB-425, Task Order No. 4
Image Enhancement Viewer Studies

Forwarded herewith for your information and file are two (2) copies of the subject report covering the period 1 May through 20 May 1962.

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✓ Chief, Contracts Staff, DPD

Enclosure: DPD-3449-62, 2 copies

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9043 Monthly Status Report

Report for period 1 May 1962 - 20 May 1962

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INTRODUCTION:

This period was spent in setting up a schedule for Phase I work, obtaining personnel and assigning them specific tasks, and in making the purchases of optical and associated equipment related to the modification to the viewing end of the Image Enhancement Viewer. Work on the theoretical studies was initiated.

The project was assigned an Itak number 9043 and the program broken into four sub-tasks. This breakdown is as follows.

EQUIPMENT MODIFICATION 9043.01:

1. Design, construct, assemble, and test necessary modifications to the Image Enhancement Viewer which incorporated the following:
 - a. Tri-ocular microscope, with variable (ZOOM) magnification, incorporating a 35mm camera to photograph the magnified image;
 - b. Change the present format to 70mm, using a standard 70mm magazine and transport mechanism;
 - c. Provide for mensuration of the aerial image through the use of a Filar eyepiece, and allow for angular measurements through calibrated rotation of the tri-ocular microscope mounting;
 - d. Provide a focussing adjustment for the 70mm format, to allow finer adjustment of the focal plane and a more critical adjustment of the system focus;
 - e. Provide a screen (ground glass or equivalent) for viewing the unmagnified image;
 - f. Provide the proper amount of front surface mirrors of the requisite quality to fold or deflect the images so that the requirements of items a through e above, may be made compatible.

2. Rearrange the collimating lenses (presently mounted together and in front of object space) to provide an exact scale in frequency space and to facilitate instrumental adjustment by auto-collimation. This is to be carried out only if sufficient space on the bench is available (or can be accommodated in the folding or deflection implicit in Item 1, above). If not deemed feasible because of inadequate length, frequency space must be calibrated with standard objects and so recorded in the manual due at the conclusion of Phase II.
3. Repair, replace, or modify the shutter arrangement in the Source unit of the Viewer. Present location and operation requires manual adjustment of shutter speed and is not conducive to normal shutter life.
4. (Optional, in anticipation of Phase II). Consider (sketch out if feasible) modifications to produce semi-automatic power supply adjustment for operational simplification of the d.c. Power Supply.

THEORETICAL STUDIES 9043.02:

1. Correct mathematical filter descriptions outlined in the 9019 final report as they incorporate amplitude weighting of the filter cross-sections. Recompute the relevant functions and replot the Figures.
2. Develop the necessary mathematics for the mechanical rotating, attenuating filters, following the principles outlined in the 9019 final report.
3. Using a Gaussian model, provide typical filter contours for purposes of developing mechanical techniques for their construction; to be used in conjunction with the engineering developments of the rotating techniques.

4. Complete the analysis of non-sharp pulses (Gaussian edges) passed through occluding filters, for use in evaluating the performance of these filter types. Derive the mathematical expressions describing how these filters may be used to enhance photographic edges (through two photographic processes) and using a suitable criterion for evaluation, indicate their specific usefulness in operating on the frequency content and general edge contrast of aerial images. These results will be tested in experiments under 9043.04.

ENGINEERING DEVELOPMENT 9043.03:

1. Design and construct a mechanism or mechanical assembly for achieving frequency attenuation by means of a contoured slot rotating in frequency space about the optical axis. The following will be considered and/or incorporated:
 - a. Rotation of a circular disc containing the contoured slot, utilizing rim-drive or equivalent.
 - b. Positioning mechanism which is adjustable in two-coordinate positions (x and y) perpendicular to the optical axis. Both manual and electrical (selsyn) centering adjustments should be considered.
 - c. Provide a means for reasonably rapid and simple filter change.
 - d. Consider, test, and remove variations due to vibration or transient shock, incorporating isolators or shock mounts as required.
 - e. Develop methods for cutting out or forming the precise slot contours provided by the mathematical analysis. This is primarily a shop problem.
2. Test the filters and rotating filter mechanism to establish general feasibility, paying specific attention to the problem of centering stability and introduction of vibration.

3. Draw up general system specifications for Phase II program.

EXPERIMENTAL TESTING 9043.04:

1. Perform tests of spatial filtering with occluding filters on objects of known edge gradient, for the precise evaluation of occluding filters and their use in image enhancement. It will be necessary to construct such test edges, the physical constants of which will be given by the mathematical studies in conjunction with studies on real photographic edges.
2. Using the test objects above, demonstrate the qualitative enhancement resulting from the use of the new mechanical frequency attenuating filters.

The next report period will cover 20 May - 20 June. It is expected that most of the theoretical studies will be complete by this time, as well as the design of the viewing modifications. Work on the engineering development of the mechanical frequency attenuating filters will be initiated, and the basic equipment such as motors, servos, micrometers, etc. will be purchased. Preliminary evaluation of the occluding filters should begin during this period.